

species of *Machaeranthera*. They were *Aster Pattersonii* Gray and *Aster coloradensis* Gray. *A. coloradensis* seems to be related to *A. Pattersonii* and if that is placed in *Machaeranthera* I think *A. coloradensis* should also be placed there.

Of the species with shorter green tips of the bracts, *M. spectabilis* Greene and *M. Selbyi* are very similar; the characters which distinguish them are slight. *M. viscosula* Rydb. is characterized by very narrow leaves.

## II

The species under my second division are equally difficult of discrimination. *M. canescens* and *M. superba* seem distinct enough; but *M. pulverulenta*, *M. divaricata*, *M. subalpina*, *M. ramosa*, and *M. glabella* are more difficult of separation. That they are related to *M. canescens* seems evident, and that they are quite closely related to each other also seems evident. Whether there are characters by which they may be separated into distinct species is rather doubtful. In the Fl. of N. Am. by Torrey and Gray the genus name for these plants is *Dieteria*, and under *Dieteria divaricata* it is observed that "these species are so nearly related that they may hereafter be found to pass into each other."

WINDSOR, COL.

## THE FRANKENIACEAE AS A LINK IN THE CLASSIFICATION OF DICOTYLEDONS

ALFRED GUNDERSEN

An interesting difference between the system of Bentham and Hooker and that of Engler appears in the position of the Pink Family, the Caryophyllaceae. In the former system this family is classified with Frankeniaceae and Tamaricaceae, in the latter under Centrospermae with Chenopodiaceae, Aizoaceae and others. The many detailed characters in common between the families Caryophyllaceae and Frankeniaceae on the one hand, and between the Caryophyllaceae and Chenopodiaceae, etc. on the other, suggest that both the above interpretations may be correct. But such a double connection would require a re-

arrangement of other families and orders. Not only the order Centrospermae, but also probably the Polygonales and Aristolochiales must then apparently follow the order Parietales or part of it. In his Blütendiagramme, Eichler makes the statement that to place the Frankeniaceae near the Pink Family, as Bentham and Hooker do, is forbidden by the placentation; the Pflanzenfamilien by its arrangement supports this view. However, studies of the placentation in various families show that in this respect also there are suggestive resemblances.

The Frankeniaceae are mostly small plants of dry regions, the interesting distribution of the five genera is indicated by the map.



Approximate Distribution of Frankeniaceae

A: <i>Anthobryum</i>	B: <i>Beatsonia</i>
F: <i>Frankenia</i>	N: <i>Niederleinia</i>
	H: <i>Hypericopsis</i>

(In South America the *Frankenia* extends into the *Anthobryum* and *Niederleinia* areas).

The general outward appearance of Frankeniaceae is much like that of some of the Caryophyllaceae. In both families the leaves are opposite, with entire margins, and without stipules. The leaves are small in Frankeniaceae, often so in Caryophyllaceae. In the Frankeniaceae the usually short petioles of each pair of leaves are connected by a scarious membrane, in the Caryophyllaceae each pair of sessile leaves is similarly connected (see plate, fig. 1-2). The inflorescence in both families is usually a dichotomous cyme.

The calyx in the Frankeniaceae is tubular and usually angular

(fig. 3-4). A tubular calyx characterizes the *Silene* sub-family of the Caryophyllaceae; an angular calyx is found in *Lychnis* and other genera of Caryophyllaceae. A calyx very suggestive of *Frankenia* is found in *Plumbago*; the possible relationship of *Plumbaginaceae* to Caryophyllaceae has been pointed out by Wettstein and others. In several *Frankenia* species the calyx is somewhat twisted, a characteristic of *Loasaceae* and of *Mesembryanthemum*. The petals with claw and ligule is another character very frequent in the two families (fig. 5-6); the margin is often fringed. The stamens, usually in two whorls, often have filaments broadened below and are sometimes slightly united, the anthers are extrorse in both families.

In both families, the pistil is one-celled, frequently of three carpels, developing into a capsular fruit. In numerous *Frankenia* species there is a slight bend at the base of the style, suggestive of the style of *Viola*. The placentation in *Frankeniaceae* varies from parietal to basal (fig. 7-10). In *Hypericopsis*, and in most of the Mediterranean and South American *Frankenias* there are 20-30 ovules on parietal placentae. In *F. grandifolia* and a number of other species only the lower parts of the placentae bear ovules. In *Anthobryum triandrum* there are two ovules just below the middle of each of the three placentae.

In the *Basigonia* section of *Frankenia* there are usually three basal ovules, in *F. Jamesii* and *F. Fischeri* three ovules basally attached almost fill the ovary. In *Niederleinia juniperoides* three ovules are attached to a single placenta. In the *Silene* sub-family of Caryophyllaceae, the placentation is central, in the *Alsine* sub-family there is usually one basal ovule. In another family of the Centrospermae, the *Aizoaceae*, a parietal placentation occurs in species of *Mesembryanthemum*. In *Lewisia Cotyledon* in the young flower the ovules appear to be in a parietal position, later with an apparently central placentation three thread-like structures continue from the funiculi to the top; in dissecting, three groups, each with about four ovules, readily separate. A very persistent character not only in the Caryophyllaceae but also in other families of the Centrospermae is the granular or pearly surface of the seed, and the same character occurs generally in the *Frankeniaceae* (fig. 11). Another important character of the Centrospermae is the curved embryo. While this character perhaps does not occur in the *Frankeniaceae*, it does

occur in the neighboring family, the Elatinaceae, and also in Cistaceae and several other families usually included in the order Parietales. However, in some of the genera apparently nearest to Frankenia, such as Dianthus and Velezia, the embryo is nearly straight (fig. 12). In sectioning a few seeds of a North African Frankenia, the embryo seems to be situated not quite in the center of the endosperm.

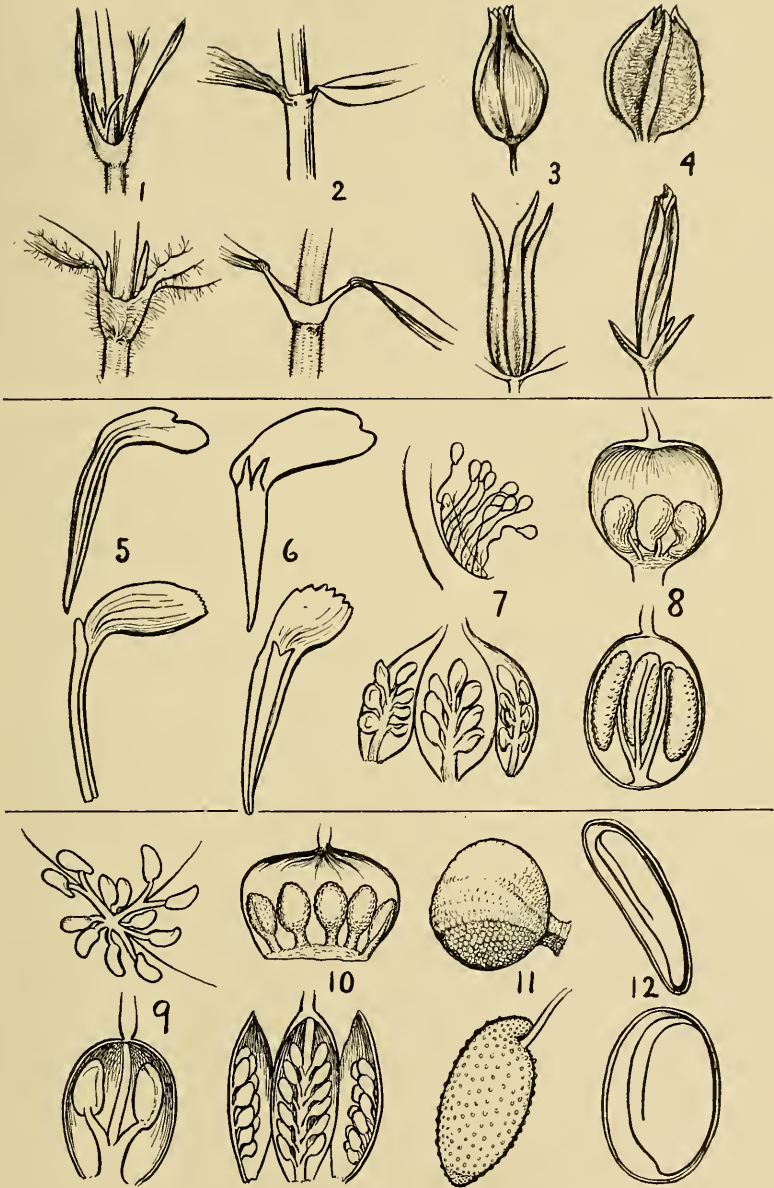
If the Frankeniaceae and the Caryophyllaceae belong together, the orders which contain them, in so far as they are natural, must also belong together. Considering only widely occurring characters in the two groups Parietales and Centrospermae, those of the former appear to be the more primitive; those of the latter the more specialized.

<i>Parietales</i>	<i>Centrospermae</i>
Largely woody plants	Nearly all herbaceous
Floral parts sometimes spirally arranged	Spiral arrangement rare (Chenopodiaceae)
Stamens often numerous	Stamens usually in two whorls
Placentation axile or parietal or basal	Placentation central or basal
Embryo straight or slightly curved	Embryo usually much curved

The comparatively late position in the Engler system of the order Parietales must be considered as due to the requirements of a linear sequence, for through Dilleniaceae and other families this group connects directly with the Magnolia group.

The great changes in classification which would follow from a recognition of a relationship of Frankeniaceae and Caryophyllaceae make it desirable to examine more closely the probable lines of evolution within these families.

BROOKLYN BOTANIC GARDEN,  
BROOKLYN, N. Y.



## EXPLANATION OF FIGURES

Above the numbers: Caryophyllaceae, Nyctaginaceae, Portulacaceae, Cactaceae. Below the numbers: Frankeniaceae





## Leaf Attachment

- |   |   |
|---|---|
| 1. { <i>Dianthus plumarius</i> L.<br><i>Frankenia grandifolia</i> Ch. & Schl. | 2. { <i>Saponaria officinalis</i> L.<br><i>F. laevis</i> L. |
|---|---|

## Calyx Tube

- |   |  |
|---|--|
| 3. { <i>Lychnis Coronaria</i> L.<br><i>F. pulverulenta</i> L. | 4. { <i>Mirabilis longiflora</i> L.<br><i>F. Jamesii</i> Torr. |
|---|--|

## Petal

- |  |  |
|--|--|
| 5. { <i>Saponaria vaccaria</i> L.<br><i>F. grandifolia</i> Ch. & Schl. | 6. { <i>Saponaria officinalis</i> L.<br><i>F. chilensis</i> Presl. |
|--|--|

## Placentation

- |  |  |
|--|--|
| 7. { <i>Mesembryanthemum spectabile</i> Haw.<br><i>Hypericopsis persica</i> Boiss. | 9. { <i>Lewisia Cotyledon</i> Rob.<br><i>Anthobryum triandrum</i> (Remy)<br>Surgis |
| 8. { <i>Pycnophyllum molle</i> Remy<br><i>F. Fischeri</i> Hicken                   | 10. { <i>Pereskia aculeata</i> Mill.<br><i>Frankenia glabrata</i> Phil (?)         |

## Ovule

## Seed

- |  |  |
|--|--|
| 11. { <i>Silene latifolia</i> Poir.<br><i>F. pulverulenta</i> L. | 12. { <i>Velezia rigida</i> L.<br><i>F. Aucheri</i> Jaub & Spach (?) |
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## PROCEEDINGS OF THE CLUB

## MEETING OF APRIL 12, 1927

This meeting was called to order at the American Museum of Natural History at 8:25 p. m. The scientific program consisted of an illustrated lecture by Dr. William Crocker entitled: The Boyce Thompson Institute: its organization and equipment for research.

Dr. Crocker spoke of the handicaps, generally existing, to the successful prosecution of research, and showed how the Boyce Thompson Institute has tried to eliminate these as far as possible. The equipment at the Institute, as well as some of the work now in progress, were described and illustrated by stereopticon slides. A more detailed account will be published later.

ARTHUR H. GRAVES,  
Secretary.

## MEETING OF APRIL 27, 1927

This meeting was held at the Museum Building of the New York Botanical Garden beginning at 3:30 p.m. The minutes